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A HIGH-VACUUM CASTING FURNACE FOR PLUTONIUM

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Work done by:
J. W. Anderson
R. L. Thomas

Report written by:
J. W. Anderson

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TECHNOLOGY--PLUTONIUM

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ABSTRACT

A high-vacuum casting furnace with an internal diameter of 15 inches has been designed, fabricated,and installed at LASL (DP West). The furnace was designed to accommodate casting crucibles up to 7 inches OD; however with a larger diameter heating element, casting crucibles up to 9 inches could be accommodated.

This report describes the basic features of the furnace and presents engineering drawings of both the furnace and furnace box.

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A HIGH-VACUUM CASTING FURNACE FOR PLUTONIUM

Figures I and II are photographs of the furnace looking through the front furnace box window. The working diameter inside of the safety crucible shown in the furnace (Figure I) is approximately 7 inches. The crucible in the basket to the right of the furnace holds the casting crucible and is lowered into the furnace with the aid of hooks. The well extending out of the furnace lid at the left contains thermocouples used for routine control. The flexible lead through the lid is a test thermocouple used for calibrating different set-ups made in the furnace.

Figure II shows the unit with the lid closed. A low pressure hydraulic cylinder is used to raise and lower the lid. The slide rod on top of the lid can be removed by turning the bar clockwise and then pulling to the right.

The furnace is heated by two parallel 10 ohm .050" tungsten wire coils wound on the outside of a 9 inch grooved alundum sleeve. The unit will heat to 1000°C in 2 hours with both legs drawing 25 amp at 80-90 volts.

A model MC 275.91 D.P.I. oil diffusion pump followed by a size 5-5-6 Kinney mechanical pump are connected to the unit. By using a house roughing system and flushing the unit twice with helium, the above pumping system will pull down to 1 micron in 15 minutes.

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Ultimate vacuums in the order of 0.02 micron have been obtained after 12 hours of pumping. In routine operation the unit can be expected to have a leak rate of less than 0.5 micron per minute.

Design features which are of general interest are listed below.

1. The entire furnace can can be removed from the furnace box.
2. A larger diameter heating element can be installed in the present furnace can.
3. The heating element leads are readily accessible and a new heating element can be easily installed.
4. Cooling coils are located on the outside of the furnace can and lid so that there is no chance of water getting into the furnace proper.
5. The furnace box windows can be easily replaced if necessary.
6. The furnace box CWS filter can be replaced by inserting a new one from the outside and removing the old one from inside of the box.
7. Brass is a very satisfactory construction material for a furnace of this type.

A complete set of engineering drawings of the furnace and furnace box (2Y-53122, B-1, D-2-18) are given on the following pages.

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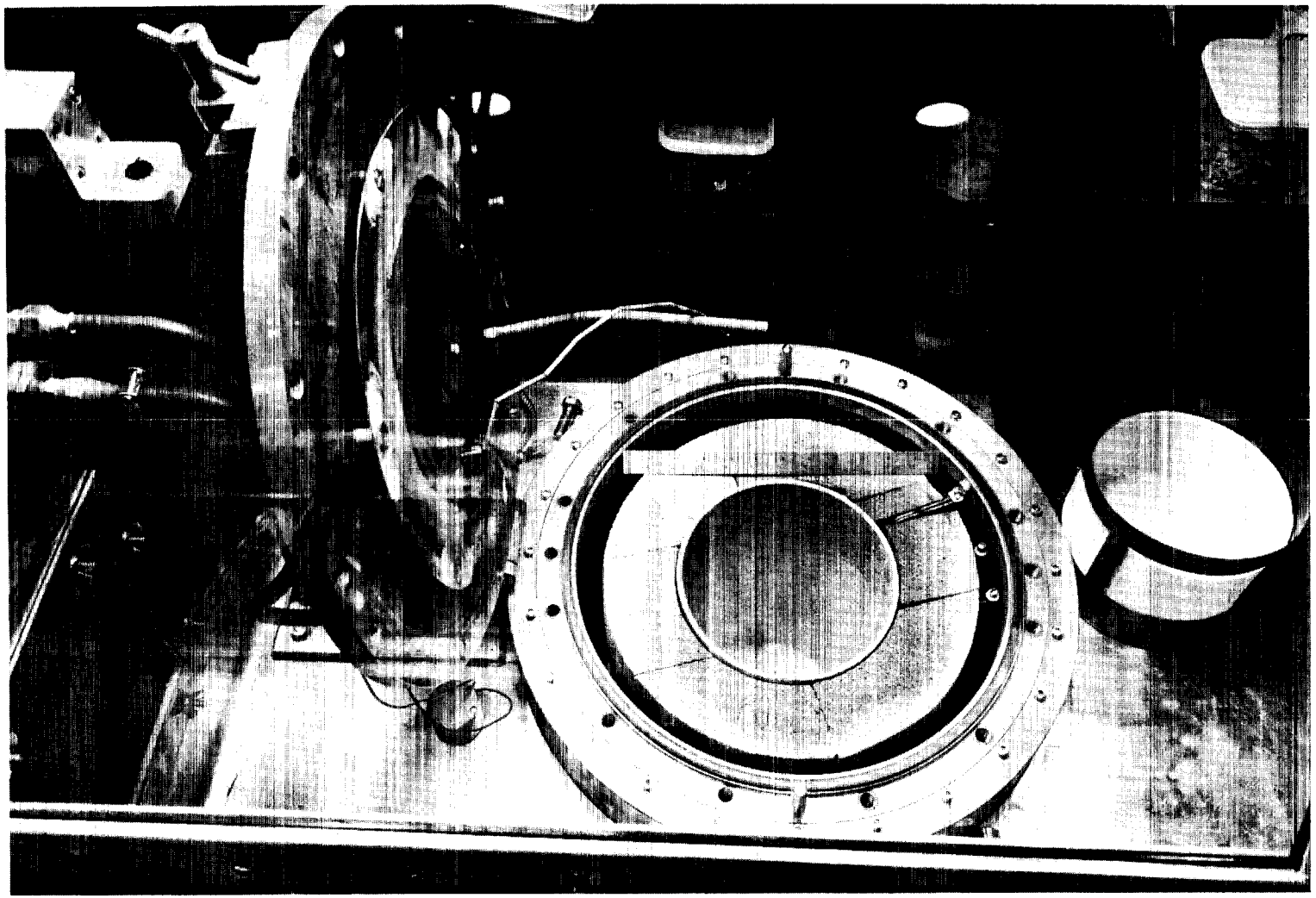

Figure I - Casting Furnace (Top Open)

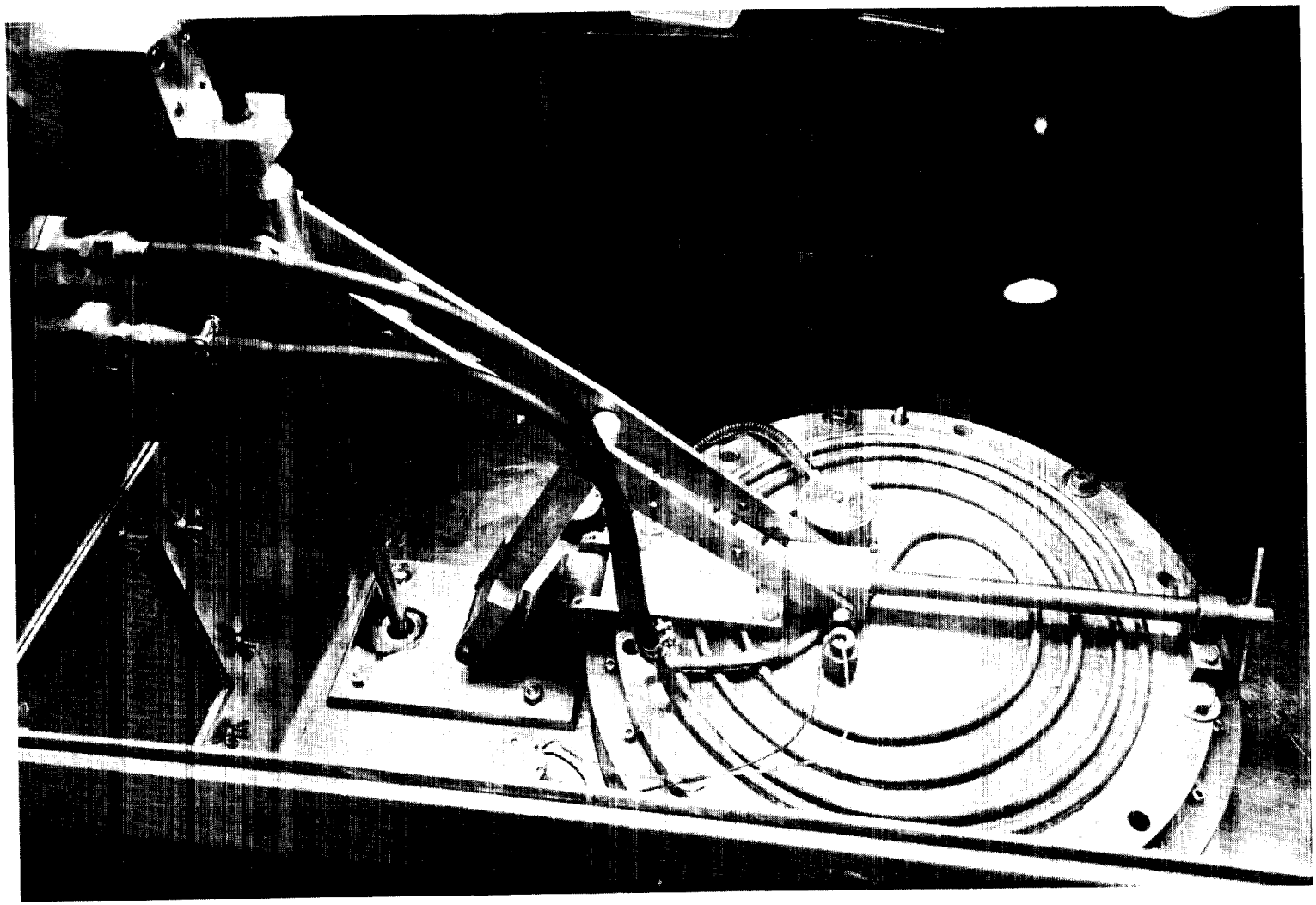

Figure II - Casting Furnace (Top Closed)

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SUB ASSEMBLY NO. 200
SHEET NO. D-12

SUB ASSEMBLY NO. 100
SHEET NO. D-13

NOTE: WIND TUBING ON COVER APPROX. AS SHOWN & SOLDER IN PLACE IN ASSY

NOTE: WIND TUBING AROUND CAN APPROX. AS SHOWN & SOLDER IN PLACE IN ASSY

NOTE: ALL JOINTS MUST BE VACUUM TIGHT

THERMOCOUPLE OPENING

SECTION A-A

SECTION B-B

SECTION C-C

SECTION D-D

SECTION E-E

SECTION F-F

SECTION K-K

SECTION G-G

SECTION H-H

SECTION I-I

SECTION J-J

CASTING FURNACE & DRY BOX

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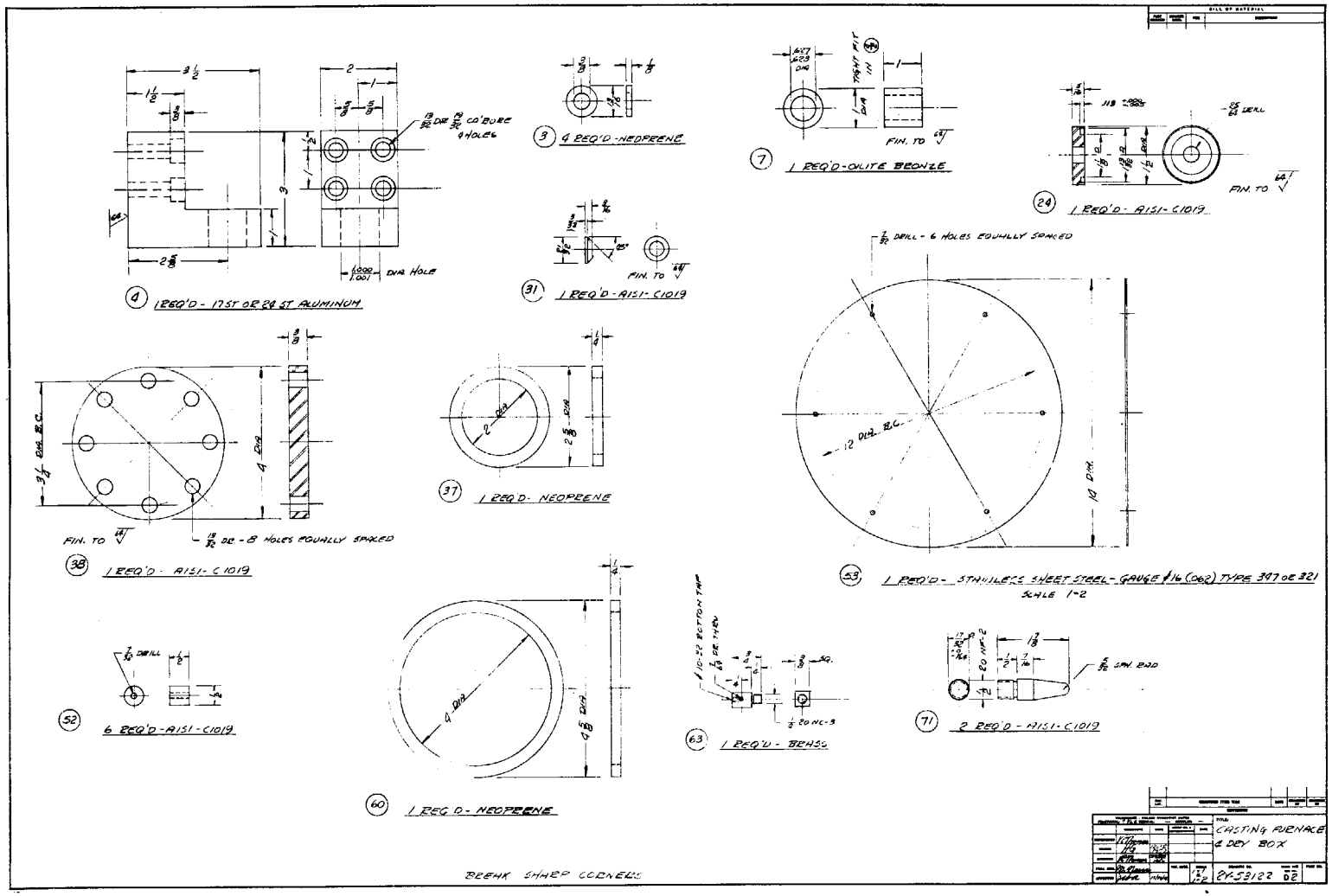

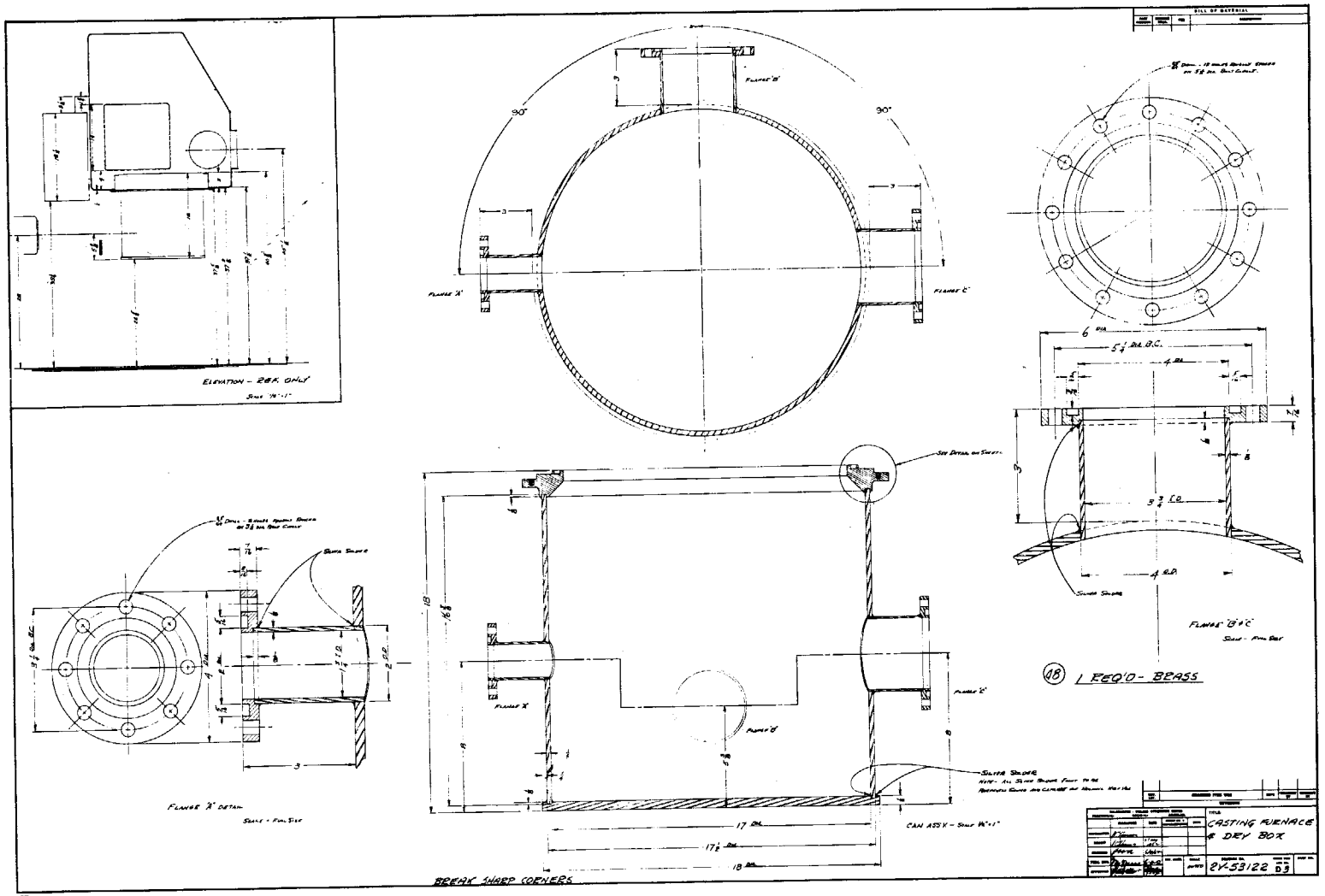

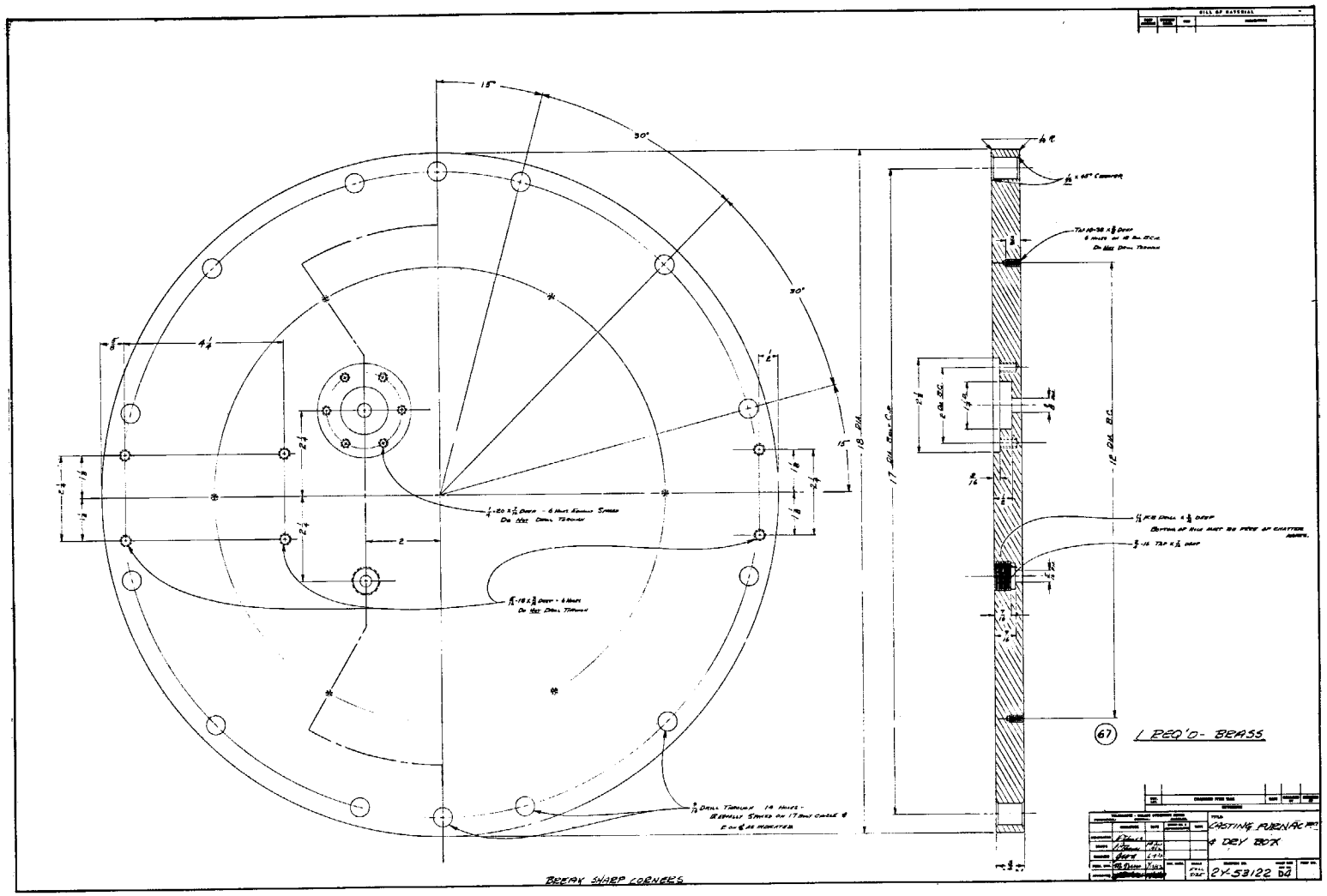

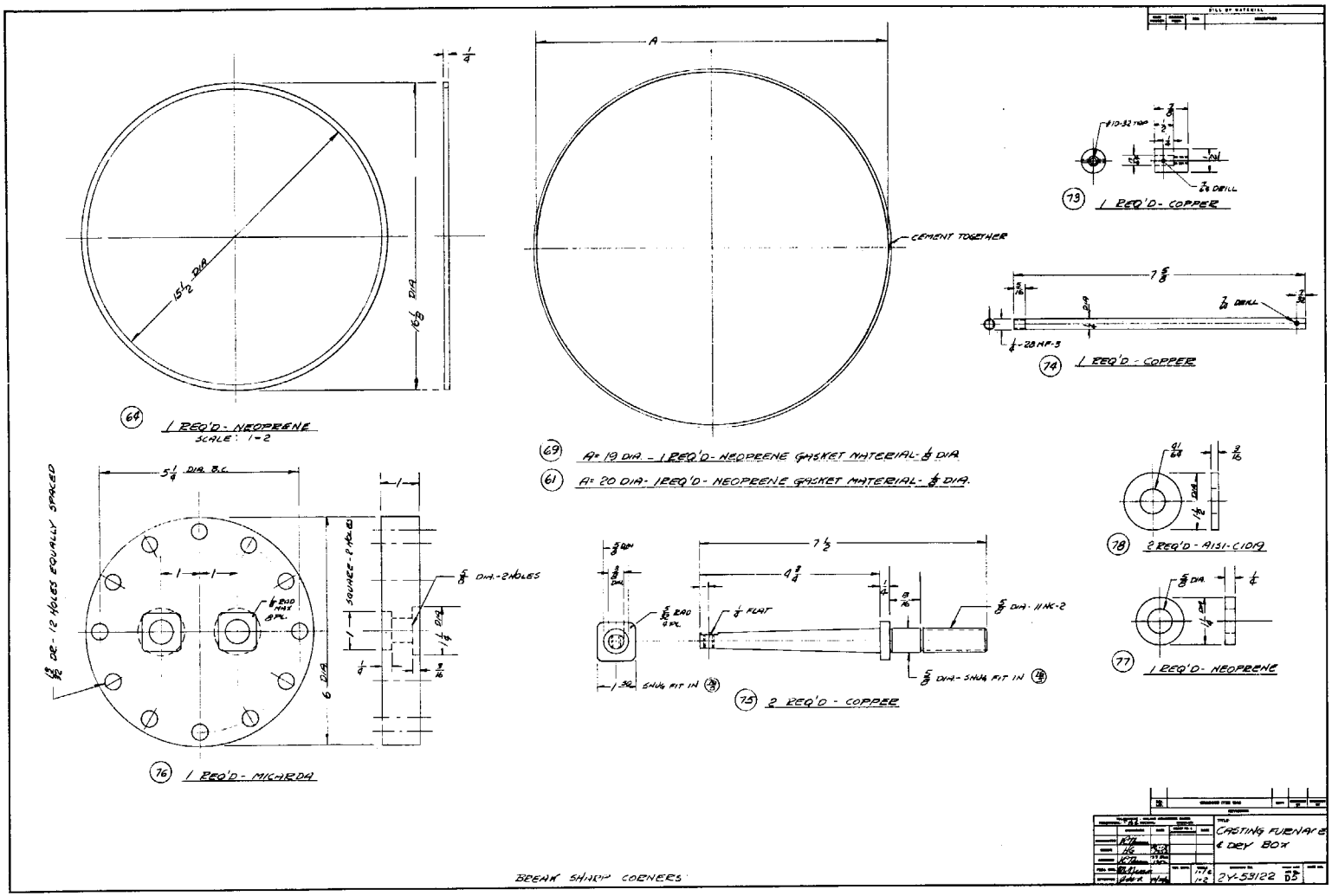

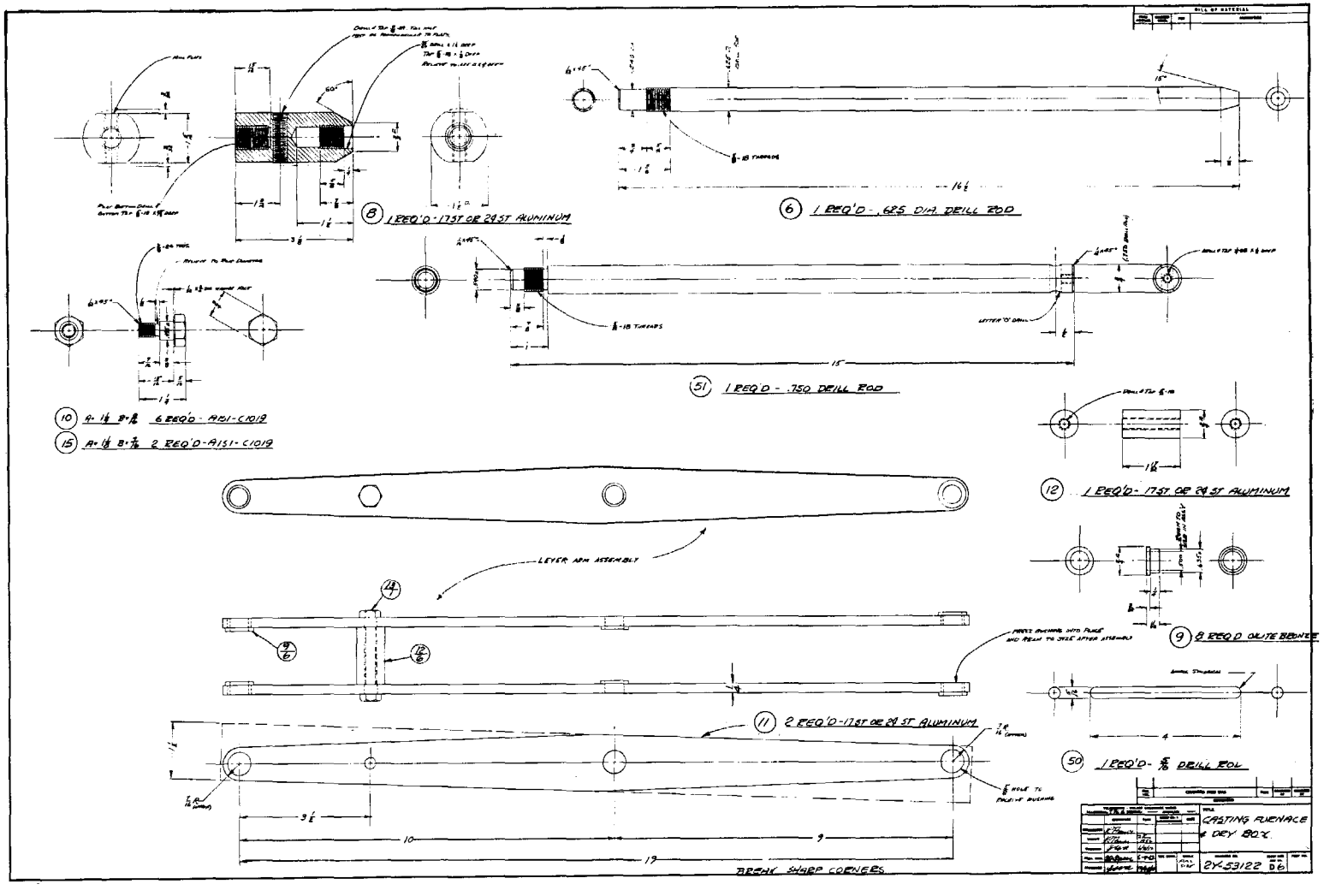

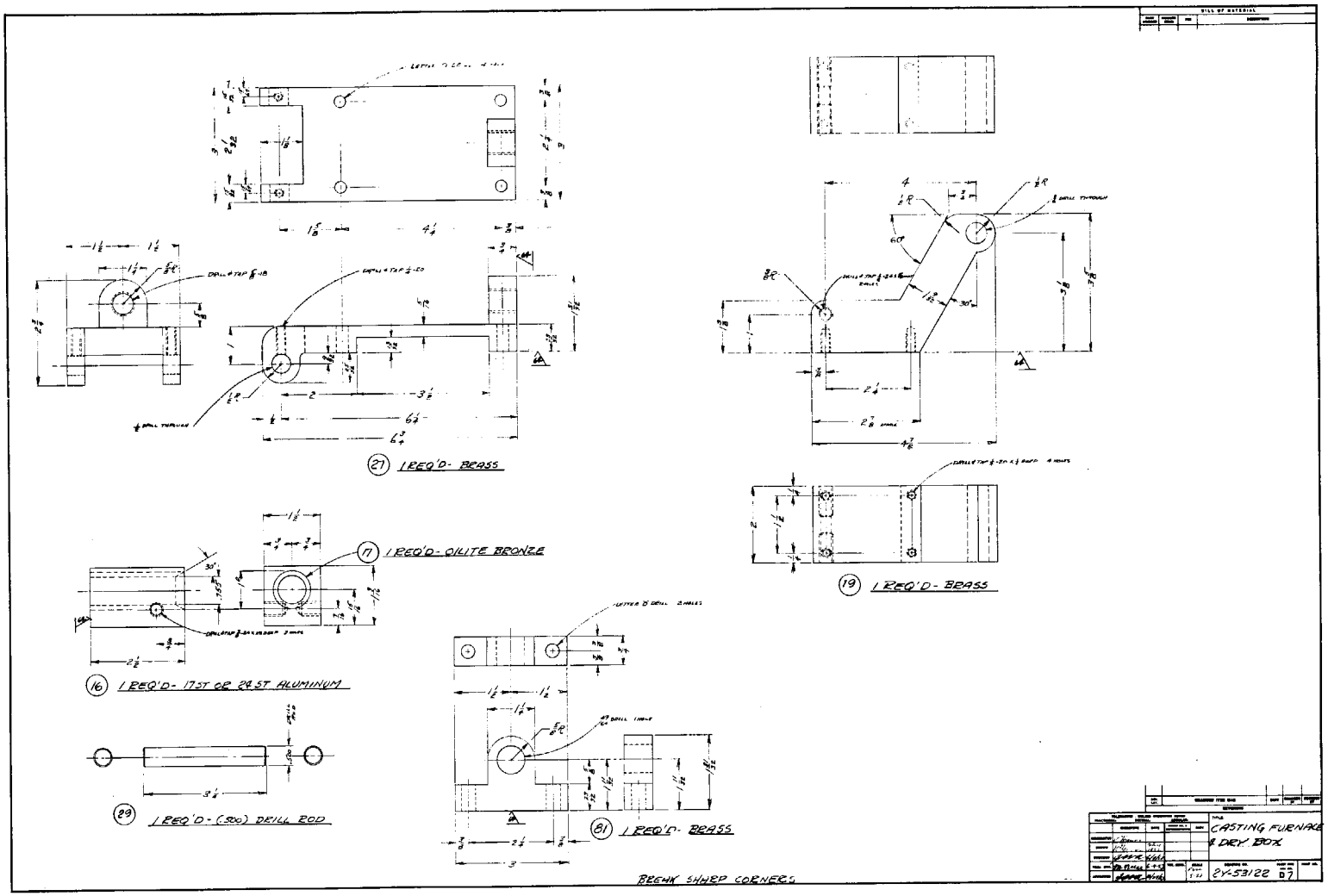

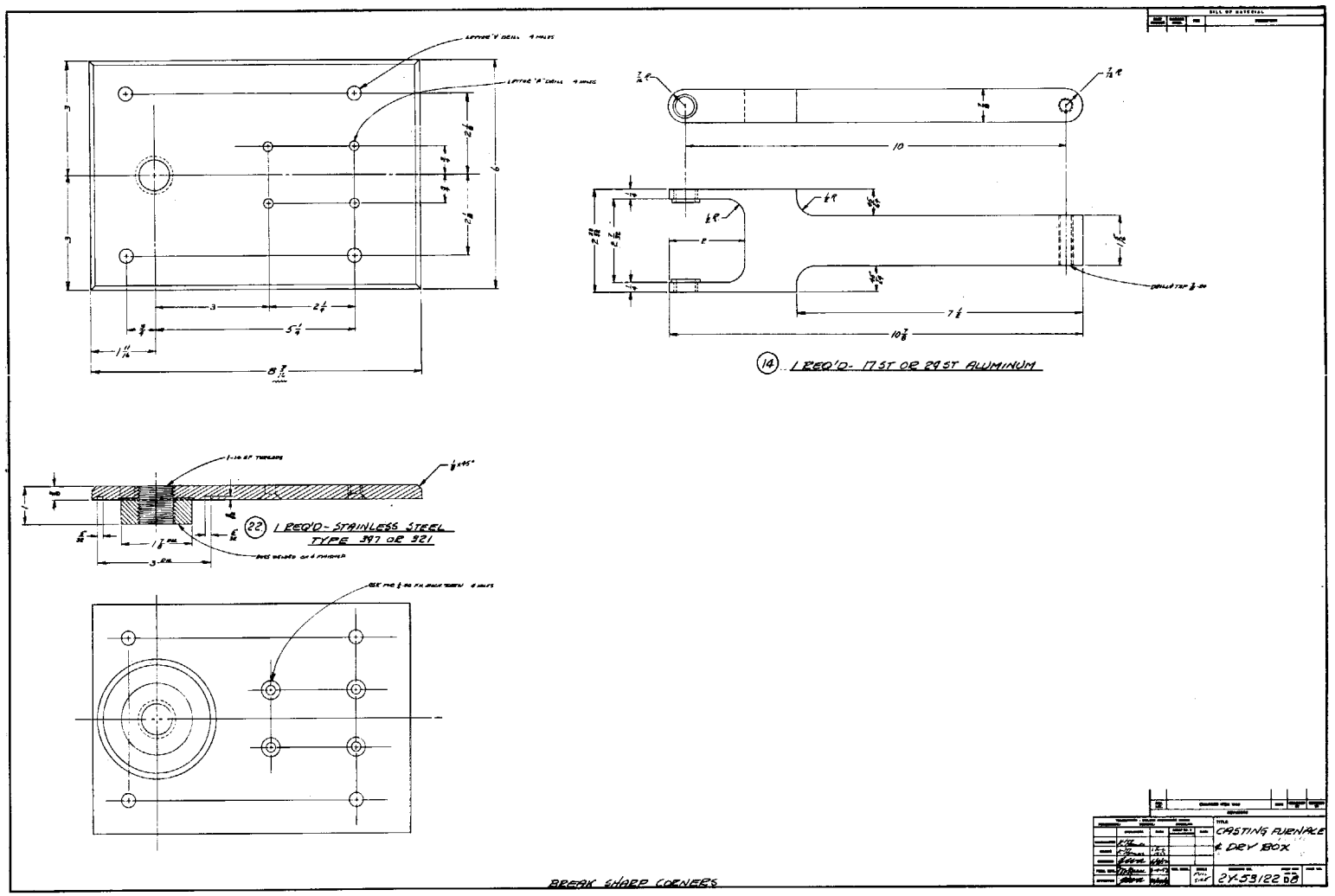

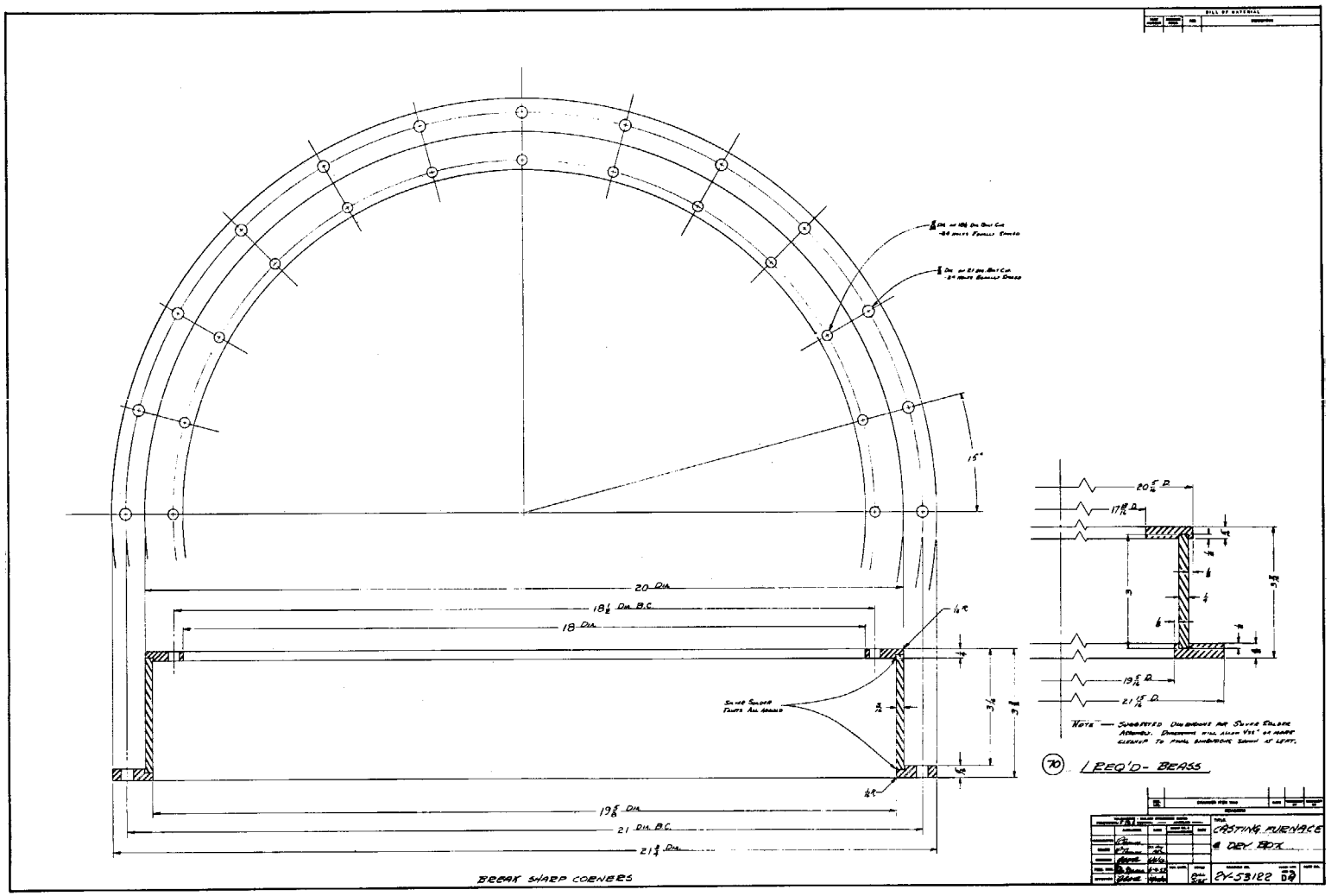

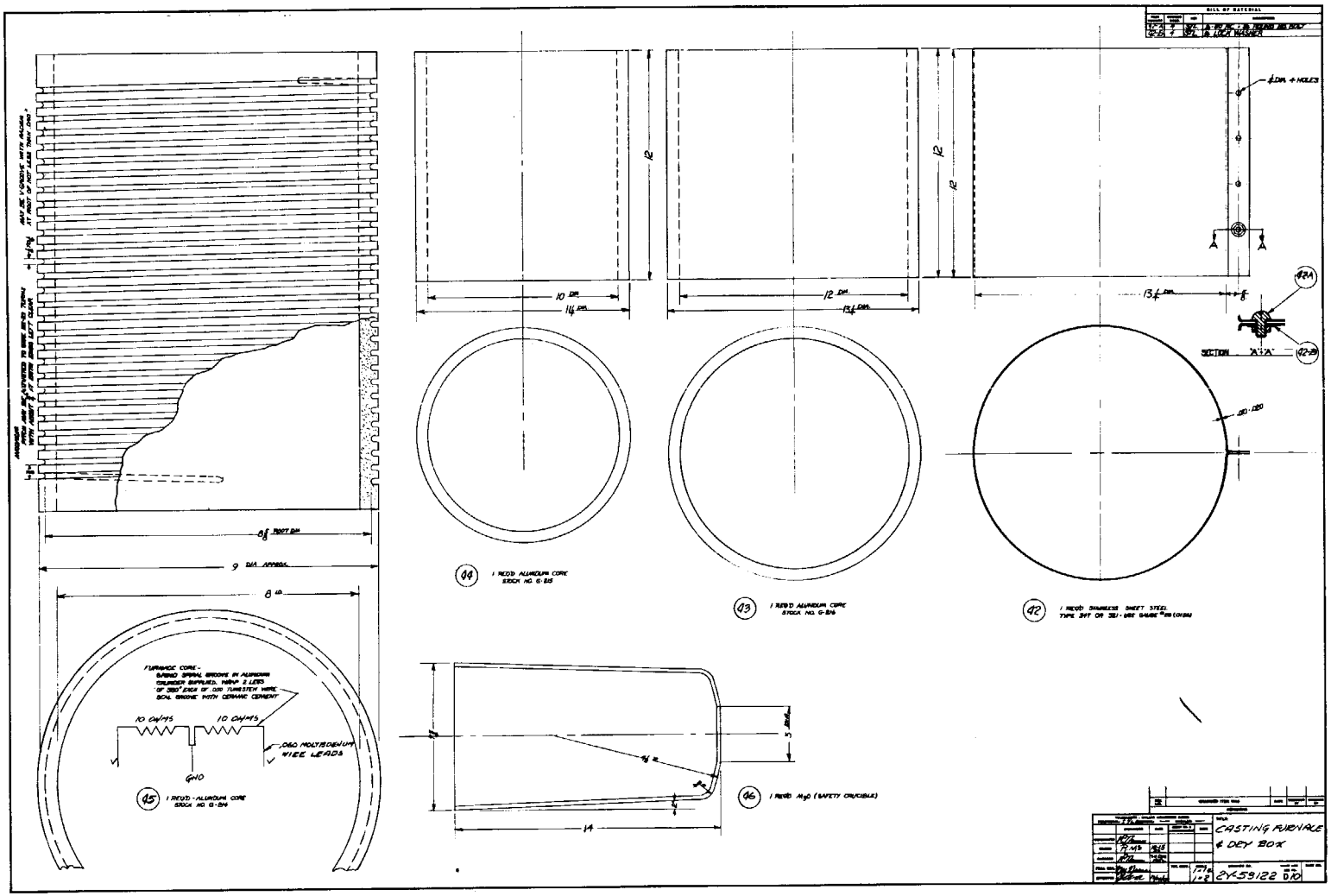

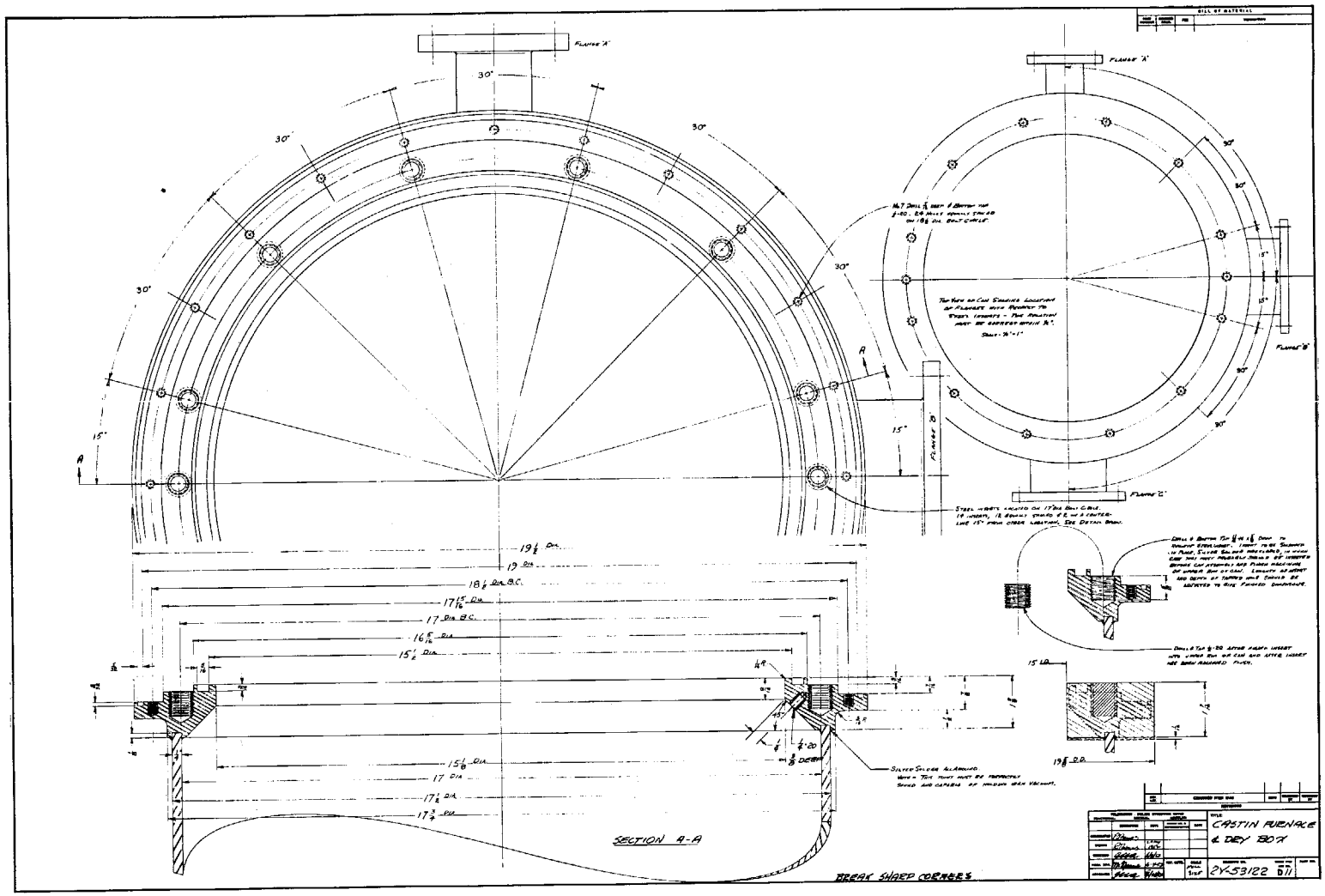

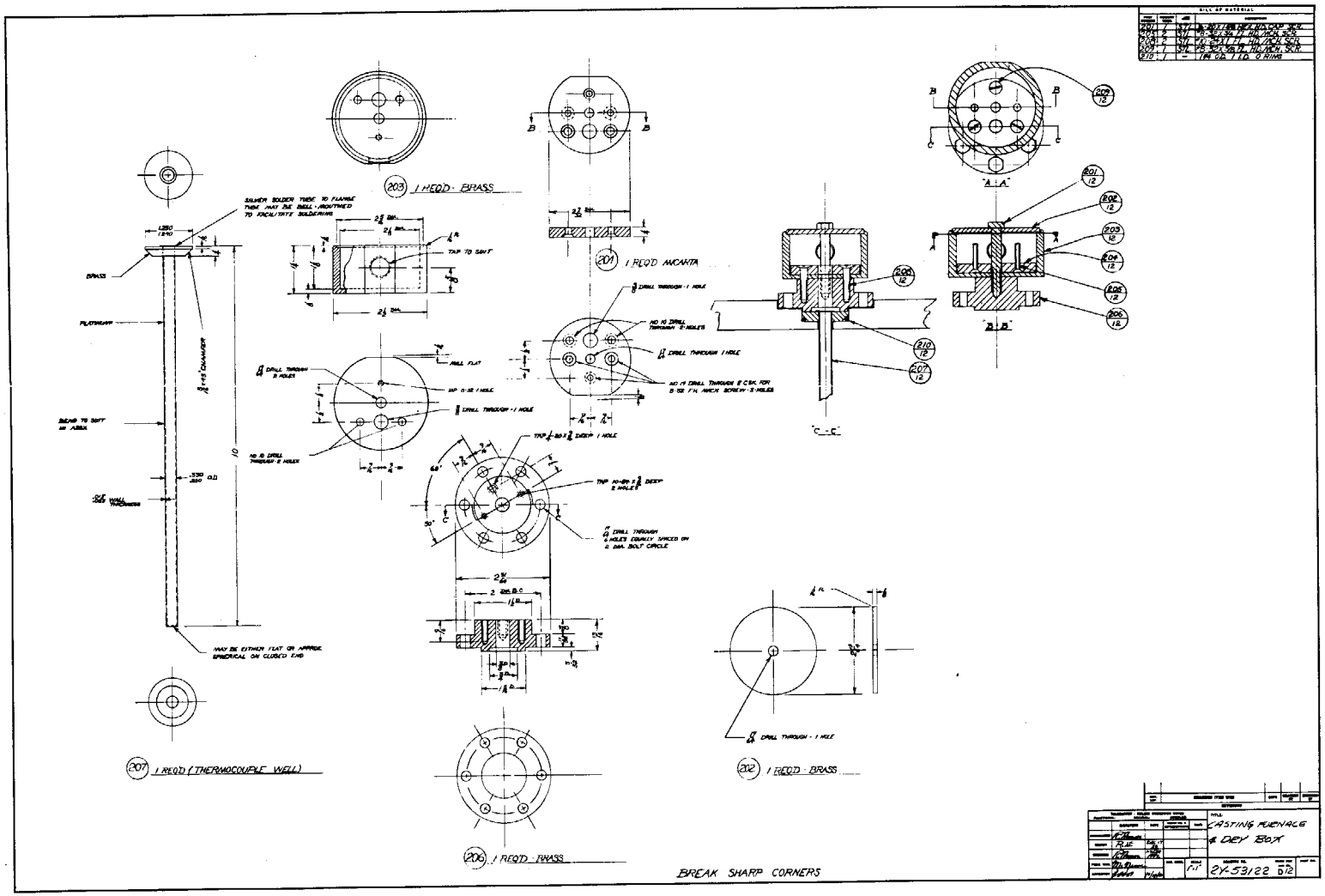

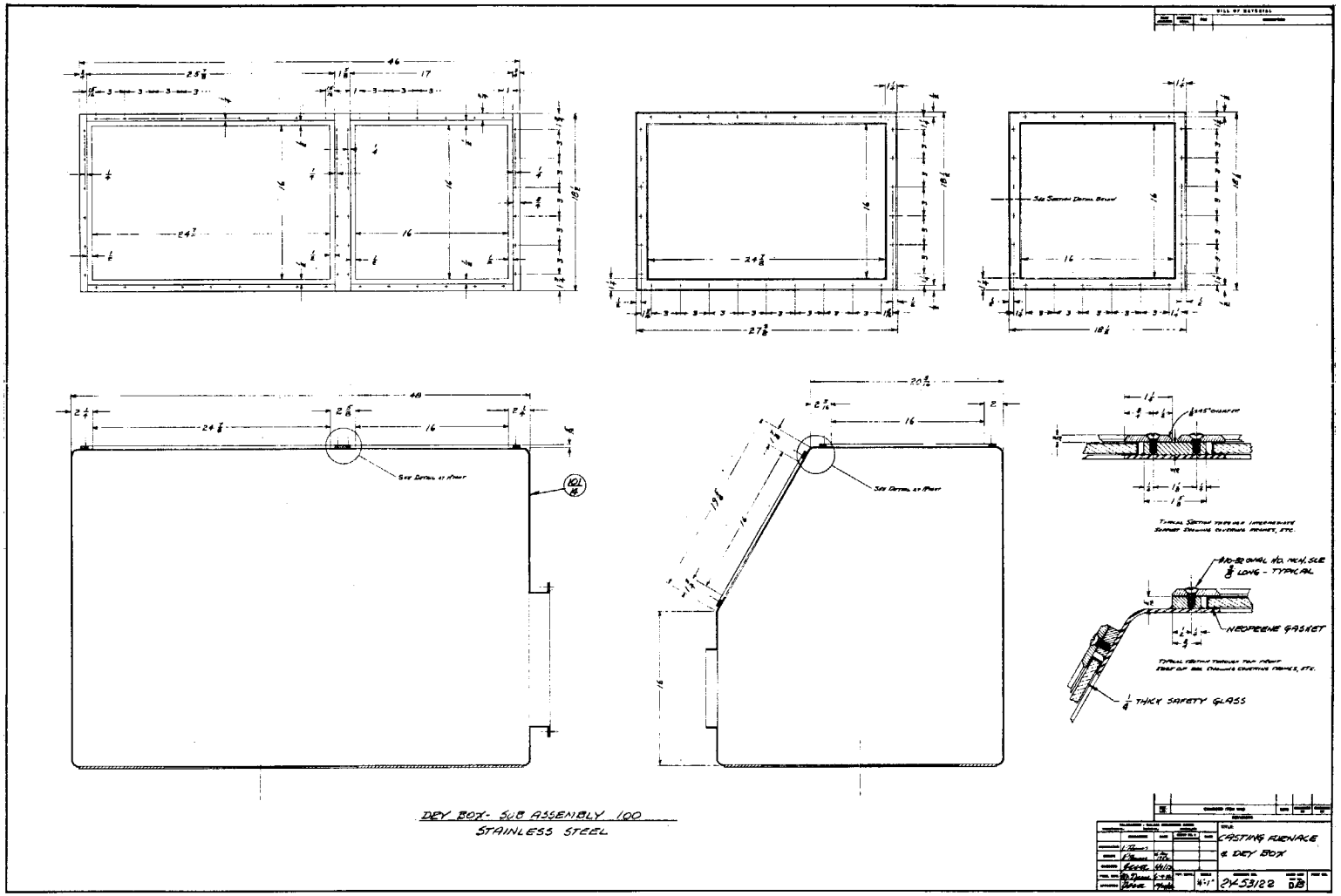

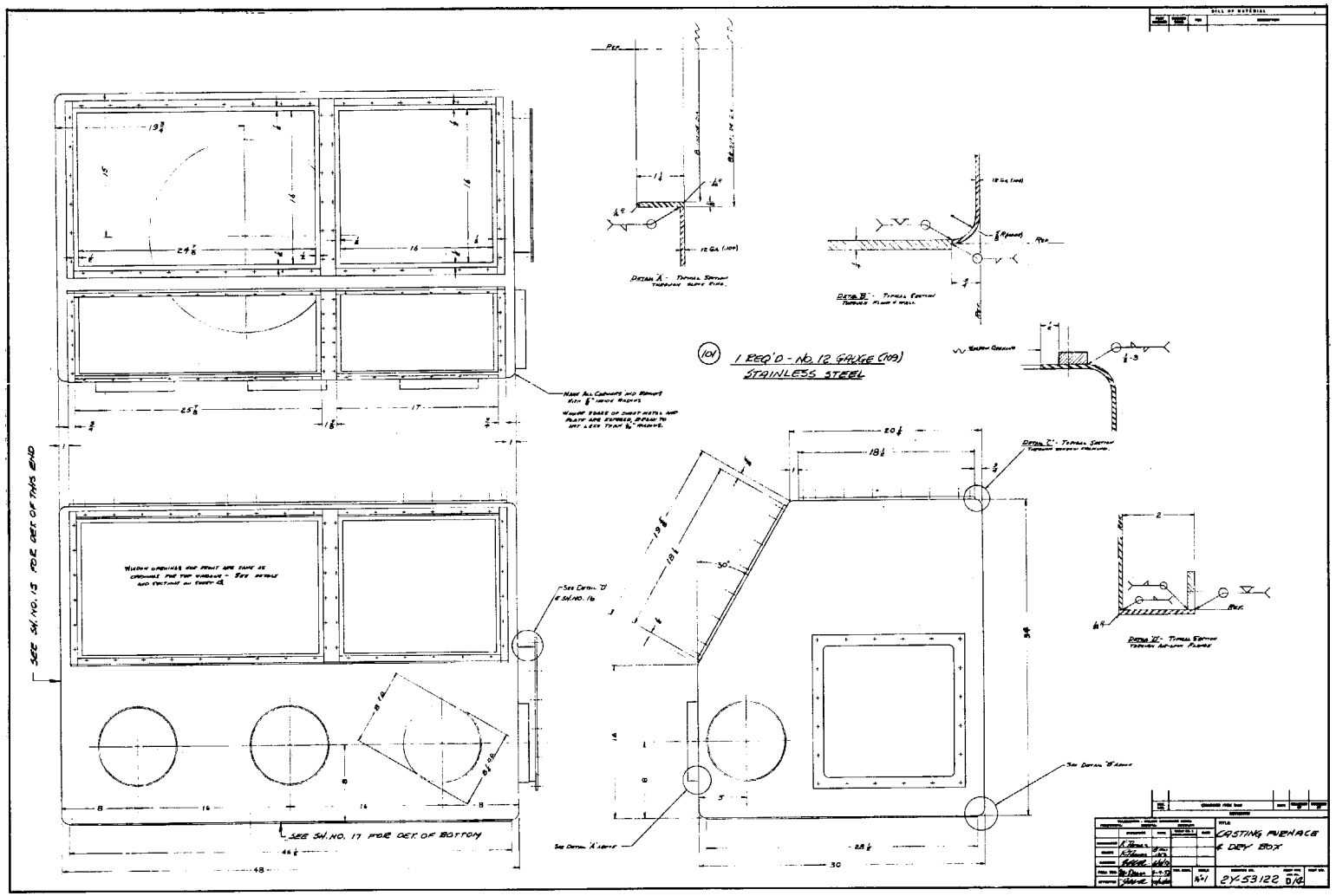

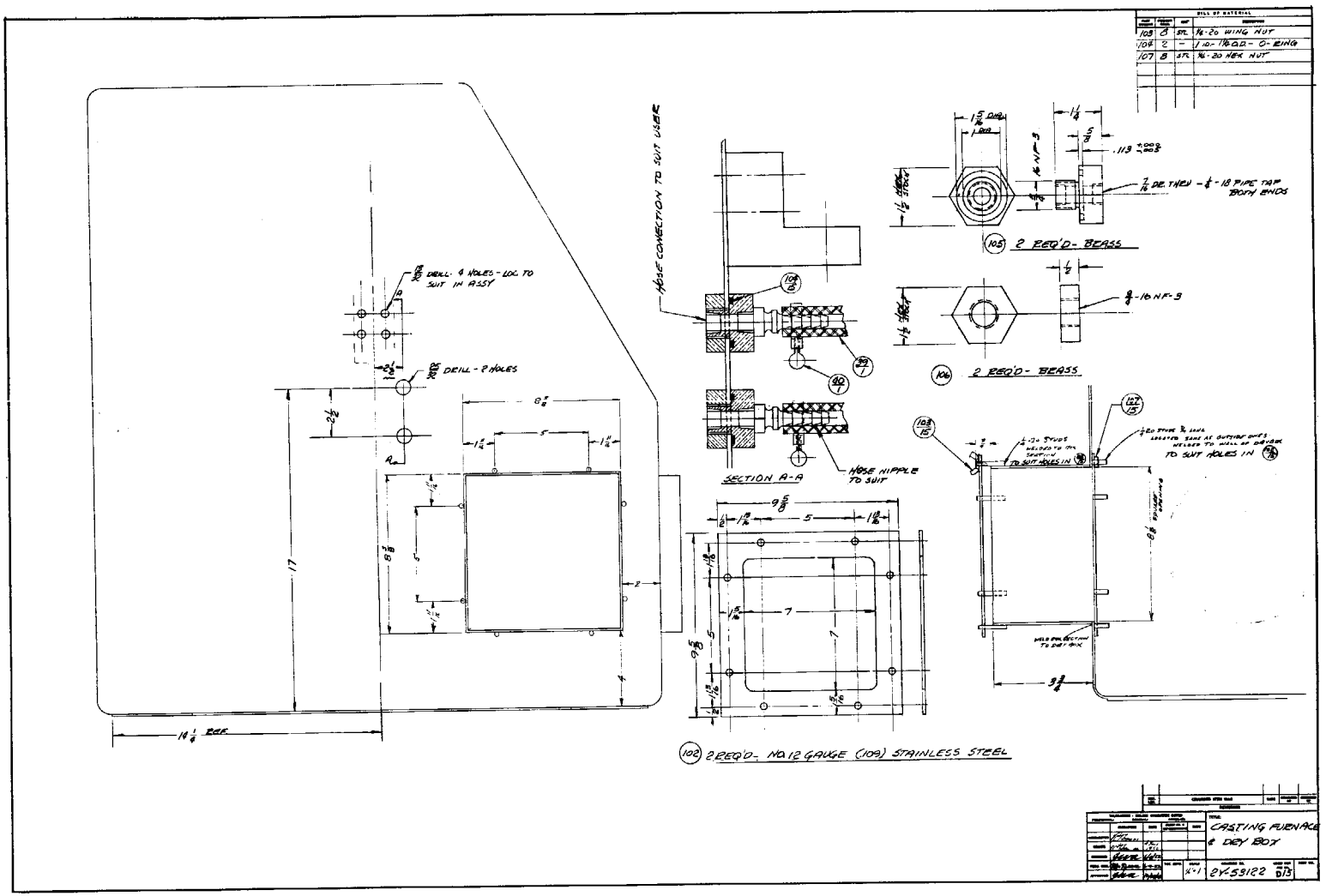

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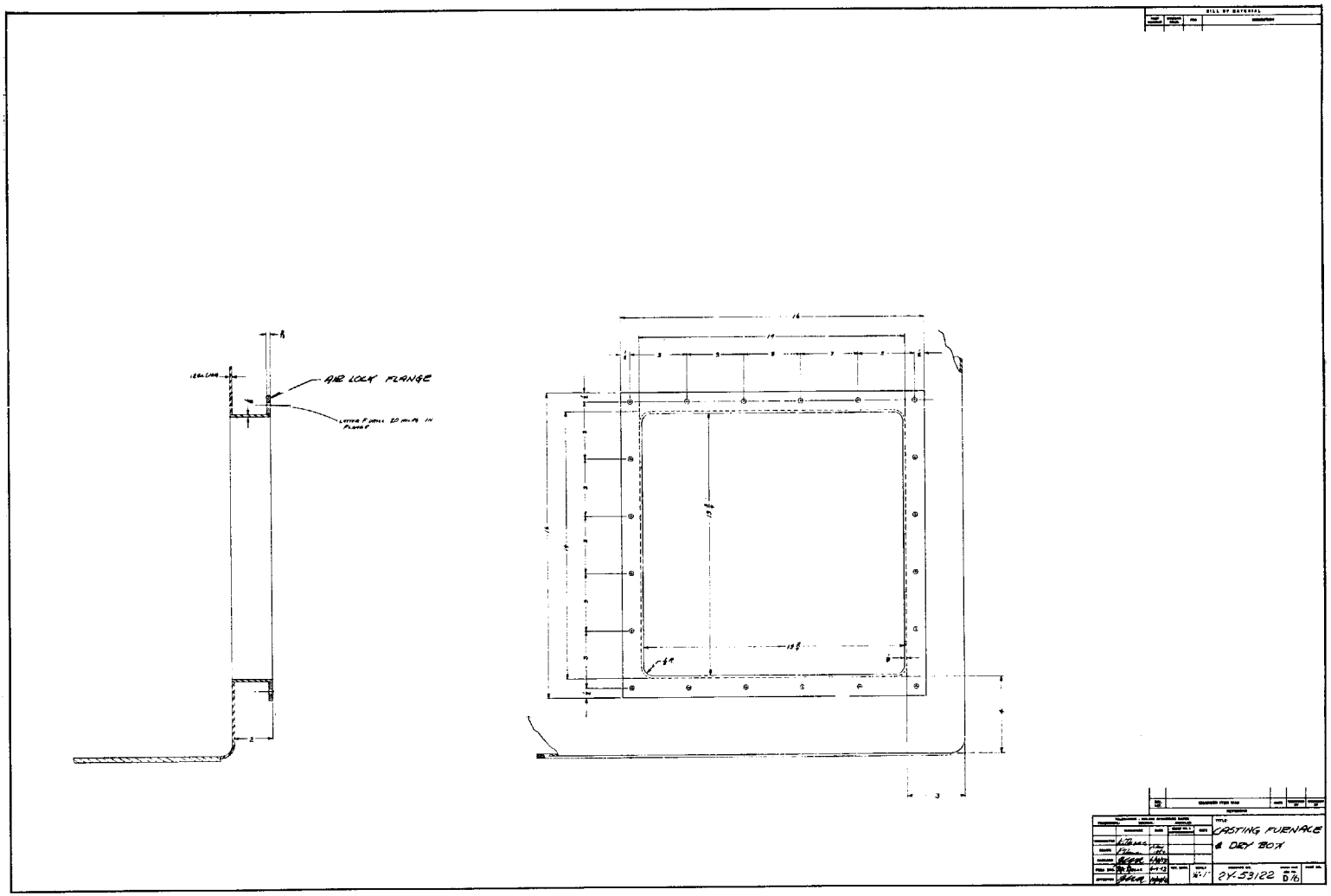

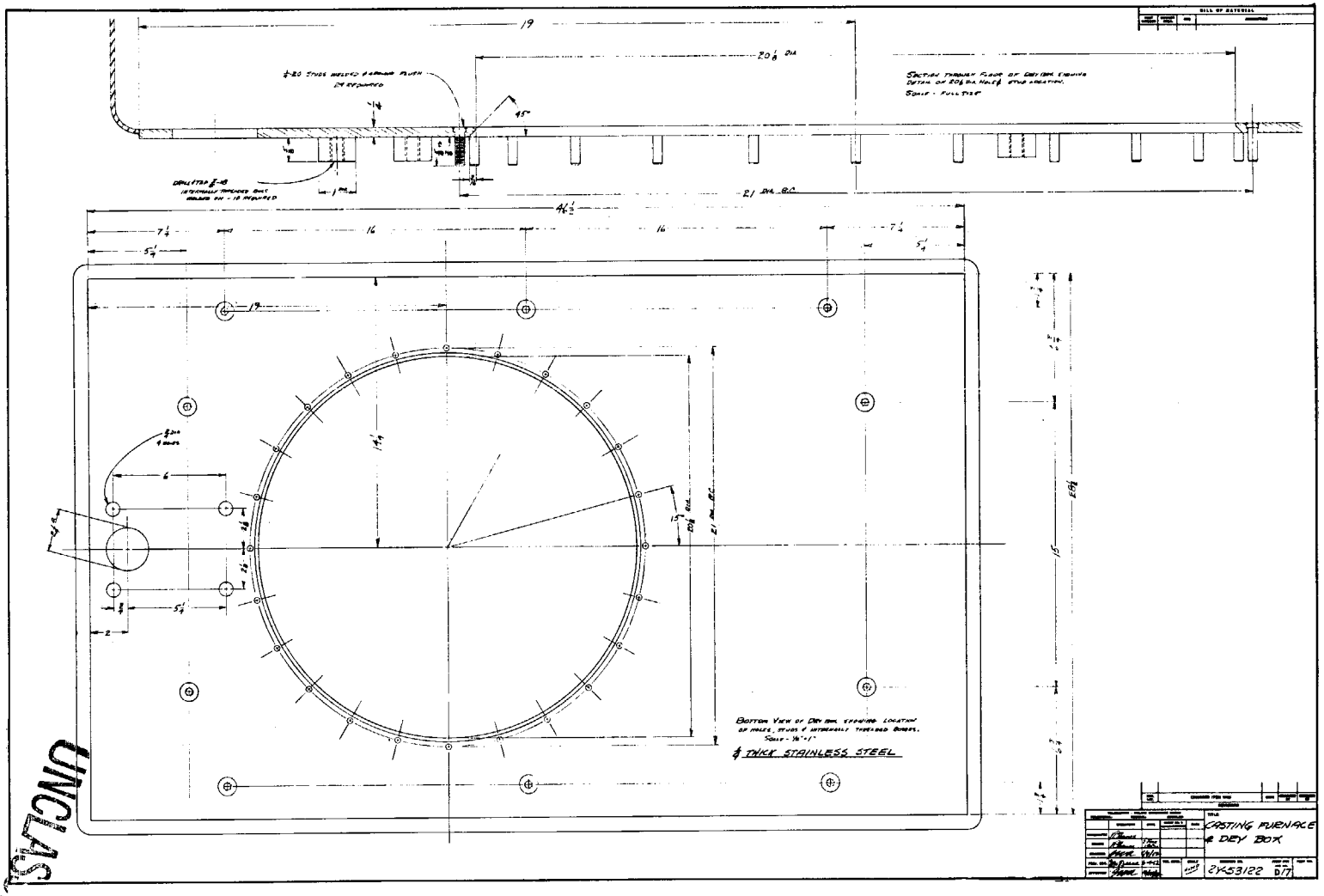

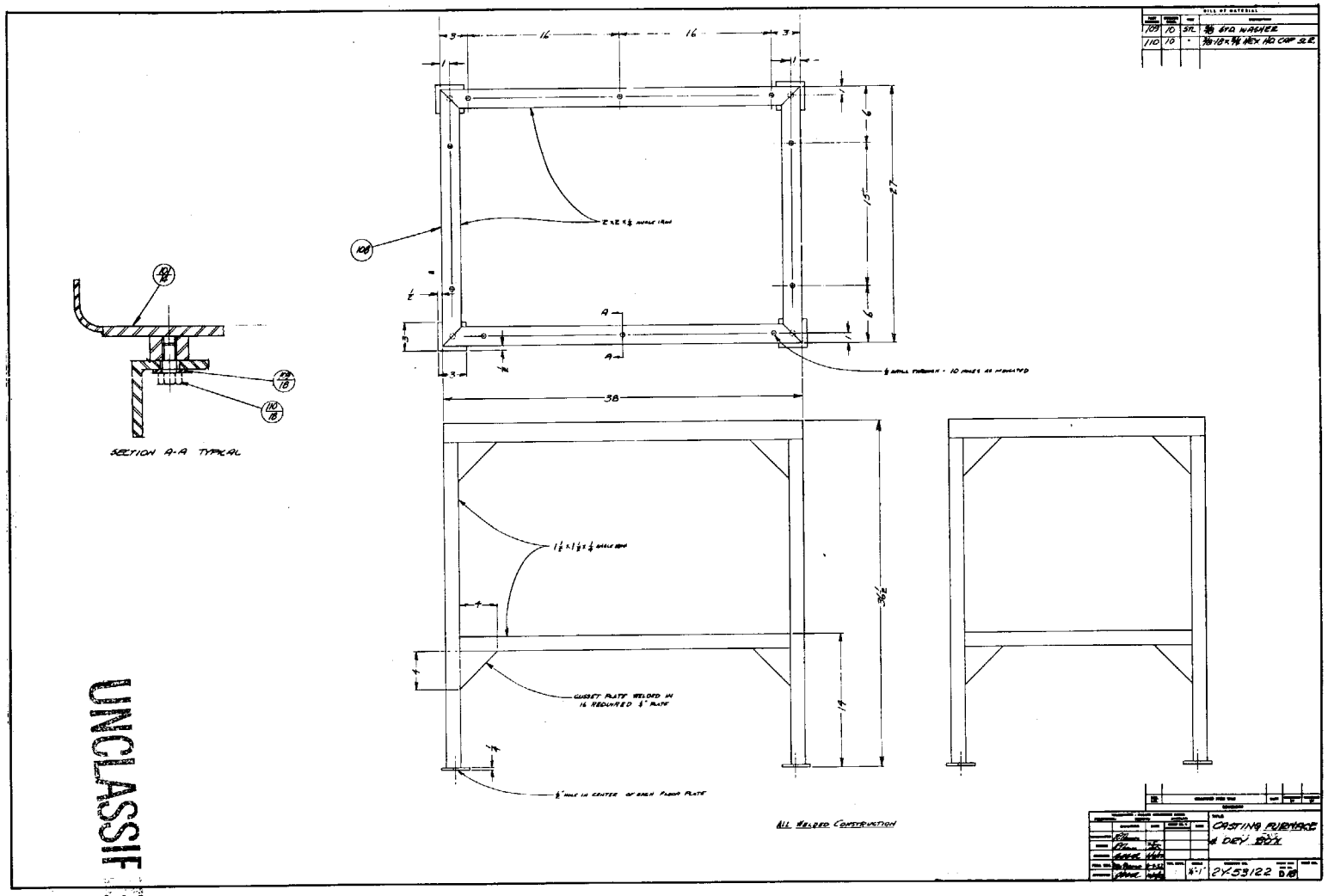

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